This is an application of the Lorentz transformations between relativistic frames of reference. We want to know what velocity of projectile is with respect to our frame of reference in the spaceship. Use eqs. 37.23, p. 1421:

\[ V_x = \frac{V_x' + u}{\frac{1}{\sqrt{1 - u^2}} + \frac{u V_x'}{c^2}} = \frac{0.7c + 0.4c}{1 + \frac{(0.4c)(0.7c)}{c^2}} = 1.1c \]

\[ V_x = 0.859c \]

(b) How long till photon torpedoes hit us?

Speed relative to our frame of reference is from part (a)

\[ V_x = 0.859c \]

and distance to travel is \( \Delta x = 8 \times 10^5 \text{ km} = 8 \times 10^9 \text{ m} \)

So \( \Delta t = \Delta x / V_x = \frac{8 \times 10^9 \text{ m}}{0.859 \times (3 \times 10^8 \text{ m/s})} = 80 \text{ s} \)

\[ \Delta t = 31.05 \text{ s} \]

2 pts